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IN THE APPLICATION  
OF  
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FOR A  
DIGITAL ELEVATION KNOB

## DIGITAL ELEVATION KNOB

### CROSS REFERENCE TO RELATED APPLICATION

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This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/396,244, filed July 17, 2002.

### BACKGROUND OF THE INVENTION

#### 1. FIELD OF THE INVENTION

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The present invention relates generally to riflescopes and, more specifically, to a digital elevation knob, for replacement of a conventional elevation knob.

#### 2. DESCRIPTION OF THE RELATED ART

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Rifles and other guns are typically equipped with telescopes for improving the hunter's targeting. The telescopes provide elevation knobs for adjusting the sight and other variables of the telescope. Presently, conventional elevation knobs on rifle telescopes have engraved or painted graduation marks to indicate adjustment of the scope. In order to relate these marks to the hunter's rifle the hunter must equate ballistic data. A separate ballistic sheet is needed for each variable including caliber,

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bullet speed, temperature, etc. The relevant art of interest describes various aligning elements for an adjustable telescopic rifle sight, but none disclose the present invention. There is a need for a digital elevation knob, retrofittable to a telescopic sight, which can be programmed for various parameters and readouts on a display screen. The relevant art will be discussed in the order of perceived relevance to the present invention.

U.S. Patent No. 5,375,072 issued on December 20, 1994, to Stephen E. Cohen describes a microcomputer device with a triangulation rangefinder for a firearm trajectory compensation comprising a computerized instrument for displacing the aiming mark of a rifle or other small arms to compensate for ballistic trajectory. The device has means for retaining data for several types of small arms ammunition, a ballistics data program, an electric aiming mark displacement system, and a display system for the outputted aiming mark adjustment data controlled by timer devices and a battery. The device is distinguishable for its integration directly with a telescopic sight and its requirement for triangulation, timers and a battery.

U.S. Patent No. 4,142,139 issued on February 27, 1979, to Mathew A. Slaats et al. describes a search mount for a telescope comprising a motorized telescope mount with an array of buttons for entering elevation and windage settings and a digital

signaling system. The digital circuitry includes a paper tape reader, a magnetic card reader, and a two-position display system with one display showing the present position of the horizontal motor, and the second display showing the data entered by the user. A photocell and lamp are used for each of two motors to count the number of revolutions of the motor shafts. The device is distinguishable for its motorized mount, manual switches, photocells, lamps, and readers for a paper tape and a magnetic card.

U.S. Patent No. 4,554,745 issued on November 26, 1985, to Otto Repa describes a device for aligning an adjustable sight element for a rifle comprising a battery driven digital eyepiece attachment that visually indicates at all times the magnitude of horizontal and vertical movement of the adjustable sight element. The device is distinguishable for its limited capability.

U.S. Patent No. 3,990,155 issued on November 9, 1976, to Alfred A. Akin, Jr. et al. describes a riflescope elevation assembly integrated with the riflescope that reads target distance directly and provides conventional "click" elevation settings. A knob having a distance scale on its skirt is viewed through an opening in the elevation adjustable assembly. The device is distinguishable for its limitation to manual elevation settings.

U.S. Patent No. 4,038,757 issued on August 2, 1977, to Edward H. Hicks et al. describes two external adjustment knobs with a cylindrical body attached to a telescopic sight that cooperate with the adjustment screw that forms a part of the sight. The device is limited to manual operation of the riflescope's windage and elevation adjustment screws absent the conventional cap.

U.S. Patent No. 5,141,313 issued on August 25, 1992, to Robert Brun describes an apparatus for producing a collimating mark within an optical sighting device which includes a light source to generate a light beam for the mark, imaging optics and a beam splitter. The apparatus is distinguishable for being limited to enhancing optics.

U.S. Patent No. 5,528,847 issued on June 25, 1996, to Timothy D. Fisher et al. describes a variable power telescopic sight device comprising an externally located zoom adjusting ring rotatable about the sighting means' axis and modified to provide a digitally-activated zooming feature. The device is distinguishable for its required zooming structure.

None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed. Thus a digital elevation knob solving the aforementioned problems is desired.

## SUMMARY OF THE INVENTION

The present invention is a digital elevation knob for replacement of a conventional elevation knob on a telescopic rifle sight. The digital elevation knob may be built onto a new  
5 riflescope or be made to retrofit onto an existing riflescope. The digital elevation knob has a displacement sensor, a unit containing elevation programs for different ammunition, and a battery operated display screen. The digital elevation knob is mounted to a conventional riflescope. The knob is mounted to the  
10 riflescope by a generally cylindrical body having a pair of flanges. The flanges are adapted for securing a microcomputer to the elevation knob. The display screen is disposed on the front surface of the microcomputer.

A plurality of inputs supply information to the  
15 microcomputer. The information is input into the microcomputer through either a communications port or through the keyboard on the microcomputer. The input information is sent to a central processing unit where it is stored and processed. The input information contains several variables including, but not limited  
20 to, environmental conditions, ammunition data, measurement units and target data.

The elevation knob is turned, which turns a screw that is secured to a targeting element. The screw causes the targeting element to move up and down. The displacement sensor determines how much the targeting element has moved and sends a signal to the microcomputer. A weapon lay sensor also determines the pitch and cant of the gun and sends another signal to the microcomputer. These signals are sent to the central processing unit and are processed with the input information. The input information and the information from the sensor are entered into data storage and several calculations are made using trajectory programs and ballistic tables. The results of the data processing are projected on the readout display screen on the front of the microcomputer. The readout displays the corrected range and informs the user of the rifle of any adjustments that need to be made.

Accordingly, it is a principal object of the invention to provide a digital elevation knob for a telescopic rifle sight.

It is another object of the invention to provide a retrofittable digital elevation knob device having a display screen.

It is a further object of the invention to provide a digital elevation knob device having a peripherally located displacement sensor.

Still another object of the invention is to provide a digital elevation knob device having a unit containing elevation programs for different ammunition.

It is an object of the invention to provide improved elements and arrangements thereof in an apparatus for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the present invention will become readily apparent upon further review of the following specification and drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an environmental, perspective view of a digital elevation knob on a rifle telescopic sight according to the present invention.

FIG. 2 is a front elevational view of the digital elevation knob.

FIG. 3 is a side elevational view of the digital elevation knob.

FIG. 4 is a top view of the digital elevation knob.



FIG. 5 is a block diagram of the data input and output of the digital elevation knob and a partial perspective view of the device.

FIG. 6 is a block diagram of the data input and out put of the digital elevation knob and a partial perspective view of the device according to a preferred embodiment of the present invention.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 through 4, the present invention is directed to a digital elevation knob device 10 for a telescopic sight 12 (FIG. 1) for a rifle, long barreled pistol, or any other form of sighted weapon. A conventional horizontal adjustment knob 14 is utilized for wind and sight adjustment. The device 10 comprises a cylindrical ribbed knob element 16 for replacement of a conventional elevation knob. The ribbed knob is inserted into a non-rotating cylindrical body 18 having a longitudinal axis coincident with the cylindrical ribbed knob element 16 and a longitudinally arranged pair of flanges 20 (FIGS. 1, 3 and 4). The rotatable knob 16 communicates with a microcomputer 22 (FIGS.

1-3) in the microcomputer 22 housing. According to preferred embodiments of the present invention the microcomputer 22 is secured to the device 10 by the flanges 20. The microcomputer 22, however, is not limited to being mounted to the riflescope in this manner and the microcomputer 22 may also be remote from the riflescope.

As FIG. 2 illustrates, a generally rectangular microcomputer 22 is attached to the non-rotating body 18 and includes a programmable computer energized by a watch-type battery or other power source (hidden). A display screen 24 in an upper portion of the microcomputer 22 indicates informative data including: (1) distance; (2) caliber of ammunition; (3) program numbers being used; (4) temperature; and other pertinent information such as direction and firing times. The display screen 24 may be any suitable type of screen including, but not limited to, liquid crystal display (LCD), laser emitting diode (LED), and plasma screens.

A plurality of push buttons 26, are positioned in a lower portion of the microcomputer 22 for selection of multiple functions and entering of numerical parameters explained in detail in FIG. 5. The microcomputer 22 also contains a displacement sensor signal reader for conditioning the signals from the sensor, a unit containing an elevation program for different calibers, and

an external interface plug-in socket 28 on one side (FIG. 3), whereby a rifleperson can enter data into the microcomputer 22 to obtain the optimum elevation setting for shooting the rifle at a specific target. The interface plug-in socket 28 (or any wireless interface accessory) is utilized to upload programs from a personal computer to the programmable microcomputer 22 of the device 10 and download firing data to the personal computer or other device. Conventional ballistic programs are available by Sierra, Oehler, and PRODAS, which can be incorporated.

Figs. 5 and 6 describe the input parameters that are entered into the microcomputer 22 of the digital elevation knob device 10. The input parameters 30 to 46 are entered into the microcomputer 22 through either the communications port 48 or a keyboard 50. The keyboard 50 enters the input data as alpha-numeric characters and also selects the particular mode that the device is set in. Input data may also be entered into the microcomputer 22 from a personal computer or other external device 49. The personal computer 22 is coupled to the microcomputer 22 through the interface socket 28 and then transfers data through the communications port 48.

The first data inputted is ammunition data 30 which accepts specific ammunition data such as (1) type of ammunition or more specific data as (2) weight of the bullet, (3) caliber or diameter

of the bullet, (4) muzzle velocity of the bullet, (4) powder load in the cartridge, and (5) drag coefficient of the bullet when fired in the barrel.

5 A second input 32 requires the scope model coefficients such as (1) the number of clicks per turn, and (2) the number of turns required.

A third input 34 associated with the second input 32 enters periodic updated software data.

10 A fourth input 36 requires the inputs of ambient conditions during firing such as (1) temperature, (2) windage in compass direction and velocity of the wind, (3) relative humidity, (4) altitude, and (5) barometric pressure.

A fifth input 38 enters firearm coefficients such as (1) barrel length and (2) muzzle brake.

15 A sixth input 40 resets the home position during the hunt after powering up the microcomputer 22.

A seventh input 42 enters sighting-in data such as correctional coefficients when the user is off the mark during practice.

20 An eighth input 44 enters what measurement units are employed such as yards or meters.

A ninth input 46 enters target data such as (1) elevation of the target, (2) direction of the target, and (3) speed of the target.

Fig. 5 also depicts a partial perspective view of the digital elevation knob device 10 according to a first embodiment. The present elevation knob 16 operates analogously to a conventional linear caliper device, such as that described in U.S. Patent No. 4,543,526, issued September 24, 1985 to Burckhardt et al., having a fixed magnetic tape on a bar over which a slider unit is disposed, the slider unit having a display screen, a magnetic tape reader, and a microcomputer for calculating linear displacement. However, in the present invention the digital magnetic tape 17 on the ribbed knob element 16 slides by the fixed magnetic tape reader in the microcomputer 22, which measures angular or radial displacement.

In use, the elevation adjuster knob or ribbed knob element 16 is rotated to rotate the digital magnetic tape element 17 having a magnetized region 19. An elevation adjuster screw 54 is manipulated for correct direction on the rifle (not shown) viewing through the cross hairs in the erector tube 56, which is supported by a position return spring 58. The magnetic tape element 17 measures the displacement of the erector tube 56.

The magnetic flux from the peripherally arranged digital magnetic tape 17 on the elevation adjuster knob 16 is transmitted to a magnetic flux transducer A 60 and a transducer B 62. Transducer A 60 transmits its signal to a signal conditioning unit A 64, and transducer B 62 transmits its signal to a signal conditioning unit B 66, wherein both signal conditioning units transmit their signal to the input-output control 52.

Fig. 6 depicts a partial perspective view of the preferred embodiment of the present invention. The digital elevation device 100 of the present embodiment uses alternate sensors as opposed to the magnetic elements of the previous embodiment. An optical element 156 is housed inside of the scope tube 112. The optical element is supported by a position return spring 158.

The user of the rifle turns the elevation knob 16, which then turns the adjuster push screw 154. Turning the screw 154 causes the optical element 156 to move up and down. The displacement of the optical element 156 is measured by an optical element feed back sensor 162. The sensor 162 sends a signal to a signal conditioning unit 64 in the microcomputer 22. The signal notifies the microcomputer the amount that the knob 16 has turned. The microcomputer 22 can then determine the displacement of the optical element 156. The optical element feed back sensor 162 may be any type of suitable sensor for determining the displacement of

the optical element 156 including, but not limited to, optical encoders, precision potentiometers, and absolute multi-turn sensors.

5 The device 100 further comprises a weapon lay sensor 160 located below the optical element feed back sensor 160. The weapon lay sensor 160 determines if the weapon is canted. The weapon lay sensor 160 senses if the barrel of the gun is raised or tilted so that proper adjustments can be made. If the weapon is canted the lay sensor 160 sends a signal to the microcomputer 22,  
10 which activates a status light on the display screen 24 that informs the user that the weapon is canted.

Referring to Figs. 5 and 6, a schematic drawing is shown depicting the path of the signals once they are transmitted from the sensors 160,162 or the transducers 60,62 into the  
15 microcomputer 22. Once the signal enters the microcomputer 22 it is sent to a signal conditioning unit 64,66. The signal conditioning unit 64,66 formats the signals so that they can be read by the central processing unit 72. The signal conditioning unit 64,66 can perform several functions including, but not  
20 limited to, converting a signal from analog to digital, regulating signals, filtering signals and amplifying signals.

The signal is next transferred to an input/output control unit 52. The control unit 52 controls the timing and flow of the

input and output data in the microcomputer 22. The input/output control 52 transmits signals to the power control element 68, the communications port 48, the central processing unit 72, and a readout unit 74.

5       The central processing unit 72 receives input data and conditioned signals from the input/output control 52. The central processing unit 72 processes the input data and signals using information retrieved from the data storage unit 76. The data storage unit 76 contains ballistic tables, operating system data,  
10       and application programs for trajectory and setup routines. Once the data is processed the central processing unit 72 transfers processed data to a readout unit 74 through the input/output unit 52.

      The readout unit 74 receives processed data from the central  
15       processing unit 72 as well as a power control unit 68 and the signal conditioning unit 64. The readout unit 74 supplies information to the display screen 24, which displays the information to the rifleperson. The readout unit 74 supplies information on the mode setting, input prompts, keyboard inputs  
20       during their entry, processing status, corrected range status, and power status. The power status is displayed by retrieving information from the power control unit 68. The power control unit 68 controls the status of the device 10. The power control



unit 68 can put the device into a sleep, wake-up, power, or charging mode. The power control unit 68 controls the signal conditioning units 64,66, the communication port 48, the keyboard 50, the input/output control 52, the central processing unit 72, the readout unit 74 and the data storage unit 76. The power control element 68 is energized by a power supply 70, which is either an internal battery or an external D.C. power source.

This integrated system of inputs and the related functions shown in FIG. 5 enables a rifleperson to accurately sight his/her telescopic sight on the specific rifle, or other type of gun, and ammunition used for the variables shown. With the present widespread use of personal computers and other electronic data devices, this invention can be used in concert with present state of the art devices to decrease the time and effort required to calibrate the riflescope. Thus, it has been shown that the present invention improves the use of prior art elevation knobs which have engraved or painted graduation marks requiring a separate ballistic sheet to indicate adjustment of the scope for each caliber, bullet velocity, temperature, and other parameters.

It is to be understood that the present invention is not limited to the present embodiments described above, but encompasses any and all embodiments within the scope of the following claims.